REMARKS/ARGUMENTS

Claims 1, 3, 5–7, 9, 10, 14–19, 21, 23, 25, 27–29, 31, 36–43, 45, and 46 are presented for reconsideration and further examination in view of the following remarks. Claims 1, 23, 28, 29 and 36 have been amended, thereby enhancing clarity of the claims. Claims 83 and 84 have been cancelled without prejudice or disclaimer. Claims 2, 4, 8, 11-13, 20, 22, 24, 26, 30, 32-35, 44 and 47-82 remain withdrawn from consideration. Claims 3, 5–7, 9, 10, 14–19, 21, 25, 27, 31, 37– 43, 45 and 46 remain unchanged.

It is respectfully submitted that the above amendments do not introduce any new matter to this application within the meaning of 35 U.S.C. §132.

In the outstanding Office Action, the Examiner withdrew claims 2, 4, 8, 11-13, 20, 22, 24, 26, 30, 32-35, 44 and 47-82 asserting that the respective species they are drawn to is not that of the currently examined Group I: Species C, Species b (figure 15b), Species A2, Species B2, Species C1, Species D4 and Species E2.

In the outstanding Office Action, the Examiner rejected claims 1, 3, 5–7, 9, 10, 14–19, 21, 23, 25, 27–29, 31, 36–43, 45, 46, 83 and 84 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement.

In the outstanding Office Action, the Examiner rejected claims 1, 3, 5–7, 9, 10, 14–19, 21, 23, 25, 27–29, 31, 36–43, 45, 46, 83 and 84 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In the outstanding Office Action, the Examiner rejected claims 83 and 84 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 3,534,906 to Gensler (hereinafter referred to as "the Gensler '906 patent").

In the outstanding Office Action, the Examiner rejected claims 1, 3, 5–7, 9, 10, 14, 15, 21, 23, 25, 27–29, 31, 36, 37, 41 and 45 under 35 U.S.C. § 103(a) as being unpatentable over the Gensler '906 patent in view of U.S. Patent No. 3,898,188 to Rembaum et al. (hereinafter referred to as the "Rembaum et al. '188 patent").

Applicants traverse the rejections as all of the features of the presently claimed subject matter are not disclosed, taught or suggested by the cited prior art of record.

Overview

Independent claim 1 is provided below as an example of the subject matter of the present application:

> A method of controlling atmospheric conditions in a portion of the atmosphere containing microscopic water droplets dispersed therein so as to produce their desired coalescence and precipitation, the method includes:
>
> (a) determining a size distribution of water droplets in said portion of the atmosphere;
>
> (b) providing a predetermined amount of a seeding material having uncharged seeding elements of a predetermined size distribution;
>
> (c) calculating a predetermined polarity and charge magnitude required for electrical charging said uncharged seeding elements by using a collision model describing collisions between the seeding elements and the microscopic atmospheric water droplets, where said collision model establishes a relationship between the size distribution of the atmospheric water droplets, the size distribution of the seeding elements, and the polarity and charge magnitude of the seeding elements;
>
> (d) electrically charging said uncharged seeding elements so as to produce charged seeding elements having said predetermined polarity and charge magnitude;
>
> (e) seeding said charged seeding elements in said portion of the atmosphere.

Specifically, claims 1 and 23 recite a method of controlling atmospheric conditions in the atmosphere containing microscopic water droplets to produce their desired coalescence and precipitation. The control is achieved by controllably urging the collisions between the water droplets to alter a collision rate between the water droplets. Urging collisions between the droplets is achieved by dosed seeding in the atmosphere a seeding material that is electrically charged to a required magnitude and polarity. The required magnitude and polarity depend, *inter alia*, on (i) the size distribution of the droplets in the portion of the atmosphere, and on (ii) the size distribution of the elements of the seeding material. According to the presently claimed

subject matter, the required (optimal) magnitude and polarity of the electrically charged seeding elements (particulate material and/or water droplets) are determined in advance by utilizing an appropriate droplet collision model. This model takes, *inter alia*, into account the size distribution of the droplets in the atmosphere, and the size distribution of the seeding elements.

The method includes, *inter alia*, "*determining a size distribution of water droplets*" in the atmosphere; "providing a predetermined amount of a seeding material having uncharged seeding elements of a predetermined size distribution; calculating a *predetermined polarity and charge magnitude* required for electrical charging the uncharged seeding elements by using a collision model...;" "electrically charging said uncharged seeding elements so as to produce charged seeding elements having the predetermined polarity and charge magnitude" (amended independent claim 1, emphasis added).

The Gensler '906 patent

The Gensler '906 patent is drawn to a process for producing coalescence and precipitation of particles (i.e., water droplets) suspended in the atmosphere by contacting such particle-containing atmosphere with a polyelectrolyte in fine particulate form (see, for example, the Gensler '906 patent, col. 1, lines 11–15 and col. 1, line 68 through col. 2, line 4). The polyelectrolyte disrupts the electrical equilibrium within the suspended particulate mass and thereby produces the desired coalescence and precipitation of atmospheric particles.

The Gensler '906 patent does not disclose, teach, or suggest *"determining a size distribution of water droplets* in said portion of the atmosphere;" "*calculating a predetermined polarity and charge magnitude required for electrical charging said uncharged seeding elements by using a collision model*;" or "providing a predetermined amount of a seeding material having uncharged seeding elements of *a predetermined size distribution"* as claimed in independent claim 1.

Applicants submit that, as the Gensler '906 patent does not disclose, teach, or suggest all of the features of the presently claimed subject matter, it neither anticipates nor renders obvious independent claims 1 and 23, and thus all pending dependent claims, which depend directly or indirectly therefrom.

Reconsideration and withdrawal of all rejections over the Gensler '906 patent are respectfully requested.

The Rembaum et al. '188 patent

The Rembaum et al. '188 patent is drawn to cationic polyelectrolytes formed by the polymerization in absence of oxygen of a monomer of a general formula $(CH_3)_2N(CH_2)_xZ$ where x is 3 or more than 6 and Z is iodine, bromine or chlorine to form high charge density linear polymers.

The Rembaum et al. '188 patent does not disclose, teach, or suggest how to achieve charged products having "predetermined polarity and charge magnitude" with the magnitudes calculated in advance.

Applicants submit that, as the Rembaum et al. '188 patent does not disclose, teach, or suggest all of the features of the presently claimed subject matter, it neither anticipates nor renders obvious independent claims 1 and 23, and thus all pending dependent claims, which depend directly or indirectly therefrom.

Reconsideration and withdrawal of all rejections over the Rembaum et al. '188 patent are respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 112, first paragraph

The Examiner rejected claims 1, 3, 5–7, 9, 10, 14–19, 21, 23, 25, 27–29, 31, 36–43, 45, 46, 83 and 84 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement.

Specifically, the Examiner alleges that the disclosure does not appear to teach how to determine a size distribution of water droplets in a portion of the atmosphere as recited in claims 1 and 23.

The Examiner has also asserted that the specification of the present application does not appear to identify any particulate material which can be utilized as seeding elements and that

determination of such to comply with the electrical charging requirements of Applicants' invention would constitute undue experimentation.

RESPONSE

By this response, Applicants cancelled claims 83 and 84. Therefore, it is respectfully submitted that the Examiner's rejection of claims 83 and 84 is now moot.

Applicants respectfully traverse the remaining rejections. In accordance with MPEP § 2164.01 ("Test of Enablement") requirement, "a patent need not teach, and preferably omits, what is well known in the art." Moreover, as indicated in MPEP § 2164, "detailed procedures for making and using the invention may not be necessary if the description of the invention itself is sufficient to permit those skilled in the art to make and use the invention." Applicants respectfully submit that the techniques for determination of size distribution of water droplets are well known in the art. Accordingly, such techniques do not need to be described in the specification. For example, the most frequently used standard techniques for determination of size distribution of water droplets are Forward Scattering Spectrum Probe (FSSP) and Fast FSSP. These techniques are based on the measurement of the time over which the droplet crosses a narrow laser beam (see, for example, Brenguier, J.-L. , T. Bourianne, A. Coelho, J.Isbert, R. Peytavi, D. Trevarin and P.Wechsler, 1998: "Improvements of droplet size distribution measurements with the Fast FSSP," *J. Atmos. and Oceanic Technology,* 15, 1077-1090).

Accordingly, reconsideration and withdrawal of the rejection of claims 1 and 23 is respectfully requested.

Further, the Examiner has improperly alleged that the specification of the present application does not appear to identify any particulate material which can be utilized as seeding elements.

This rejection is also respectfully traversed, primarily for the reason that the present application teaches that soot is one of the examples of inexpensive and easily produced materials that may be utilized as seeding elements (see, for example, page 15, lines 8–11 of the present specification). Likewise, natural water droplets (i.e. collected from the atmosphere) or droplets specifically generated to have a desired droplet size distribution, can be used as seeding elements

(see, for example, beginning on page 19, line 29 through page 20, line 5 of the present specification). Exemplary methods of generation and charging of these water droplets for providing the desired characteristics are described beginning on page 19, line 29 through page 20, line 5 and on page 20, lines 17–20 of the present specification. Moreover, a combination of water droplets and particles of particulate materials can also be utilized as seeding elements (see, for example, page 20, lines 6–10 of the present specification).

In light of the foregoing response, reconsideration and withdrawal of the rejection under 35 U.S.C 112, first paragraph of independent claims 1, 23, and claims 3, 5–7, 9, 10, 14, 15, 21, 25, 27–29, 31, 36, 37, 41 and 45, rejected seemingly solely due to their dependency therefrom, are respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 112, second paragraph

The Examiner rejected claims 1, 3, 5–7, 9, 10, 14–19, 21, 23, 25, 27–29, 31, 36–43, 45, 46, 83 and 84 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, the Examiner asserts that although claims 1 and 23 recite the phrase "by using a collision model..." these claims fail to provide any use steps.

The Examiner rejected claim 36, asserting that the recitation of size "several micron" is uncertain.

Further, the Examiner states that the limitation "collision efficiency" in claim 41 has insufficient antecedent basis. The Examiner alleges that this claim fails to indicate how the collision efficiency is determined.

Finally, the Examiner asserted that claims 83 and 84 failed to define an invention and also required the presentation of claims 83 and 84 in independent form, for administrative purposes.

RESPONSE

Claims 1, 3, 5–7, 9, 10, 14–19, 21, 23, 25, 27–29, 31, 36–43, 45 and 46 have been amended or depend from amended claims, and, as amended, the rejections thereto are

respectfully traversed.

By this response, Applicants canceled claims 83 and 84. Therefore, it is respectfully submitted that since claims 83 and 84 are canceled, the Examiner's rejections are now moot.

Claims 1 and 23 were amended to recite the use step of "...calculating a predetermined polarity and charge magnitude required for electrical charging said uncharged seeding elements by using a collision model..." thereby obviating the Examiner's 35 U.S.C. § 112, second paragraph rejection for failure to provide any use steps.

Claim 36 has been amended to recite the specific range of "...about 0.1 micron to about 20 microns..." thereby obviating the Examiner's 35 U.S.C. § 112, second paragraph rejection for uncertainty in what size is being defined by the term "several micron" in the claim.

Applicants respectfully traverse the Examiner's rejection of claim 41 for the following reasons:

The term "collision efficiency" appears in claim 41 as "*a* collision efficiency" rather than "*the* collision efficiency." Accordingly, Applicants respectfully submit that the term has appropriate antecedent basis.

Further, Applicants submit that the term "collision efficiency" is well known and widely used in the art (see, for example, the publications cited in the instant application: Grover and Beard "A numerical determination of the efficiency with which electrically charged cloud drops and small rain drops collide with electrically charged spherical particles of various densities" *J. Atmos. Sci.*, 1975, 32, pp. 2156–2165; Pinsky et al. "Collisions of small drops in a turbulent flow. Pt.1: Collision efficiency: problem formulation and preliminary results" *J. Atmos. Sci.*, 1999, 56: 2585–2600).

Moreover, determination of "collision efficiency" is disclosed in the specification (beginning on page 2, line 19 to page 3, line 1) and accordingly does not need to be indicated in the claims. Examples of calculation collision efficiency are presented in the specification for example, on page 3, lines 6–17; beginning on page 25, line 6 through page 26, line 15; beginning on page 27, line 25 through page 30, line 2, and are illustrated in figures 2, 4, 5, 9 and 10. These specification references further supports that the term "collision efficiency" is well known and widely used in the art and the determination of such would be as well. One can see from the

calculation and examples provided that "collision efficiency" is a simple concept, easily grasped and obviously well known and widely used in the art.

In light of the foregoing amendments and remarks, reconsideration and withdrawal of the rejections under 35 U.S.C. § 112, second paragraph, of claims 1, 3, 5–7, 9, 10, 14–19, 21, 23, 25, 27–29, 31, 36–43, 45 and 46 are respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 102

In the outstanding Office Action, the Examiner rejected claims 83 and 84 under 35 U.S.C. § 102(b) as being anticipated by the Gensler '906 patent.

RESPONSE

Applicants have canceled claims 83 and 84 without prejudice to the presently claimed subject matter and without prejudice to Applicants' rights. It is respectfully submitted that since claims 83 and 84 are canceled, this rejection is now moot.

REJECTIONS UNDER 35 U.S.C. 103(a)

In the outstanding Office Action, the Examiner rejected claims 1, 3, 5–7, 9, 10, 14, 15, 21, 23, 25, 27–29, 31, 36, 37, 41 and 45 under 35 U.S.C. § 103(a) as being unpatentable over the Gensler '906 patent in view of the Rembaum et al. '188 patent.

RESPONSE

By this Response and Amendment, claims 1, 3, 5–7, 9, 10, 14, 15, 21, 23, 25, 27–29, 31, 36, 37, 41 and 45 have been amended or depend upon amended claims and, as amended, the rejections thereto are respectfully traversed.

To establish a *prima facie* case of obviousness, the Examiner must establish that, *inter alia,* the prior art references teach or suggest all of the claim limitations *Amgen, Inc. v Chugai Pharm Co*, 18 USPQ2d 1016, 1023 (Fed Cir 1991); *In re Fine*, 5 USPQ2d 1596 (Fed Cir 1988); In re Wilson, 165 USPQ 494, 496 (CCPA 1970).

Applicants respectfully traverse the Examiner's rejections, since the cited prior art does not disclose, teach or suggest all of the features of independent claims 1 and 23.

The Gensler '906 patent fails to anticipate the presently claimed subject matter as recited in amended claim 1, since the Gensler '906 patent does not disclose, teach, or suggest *"determining a size distribution of water droplets* in said portion of the atmosphere." Instead of the size distribution of the water droplets, the Gensler '906 patent utilizes the measurements of density of atmospheric particles (i.e., water droplets) (see, for example, col. 3, lines 7–14), which is a measure of how tightly the atmospheric water droplets are packed together within the atmospheric mass. Applicants do not agree with the Examiner and submit that density of atmospheric water droplets is not the same characteristic as size distribution of water droplets. It should be understood that although monodispersed water droplets at a certain concentration may have the same density value as the density of polydispersed water droplets at the same concentration, the collision rate that determines the coalescence and precipitation of atmospheric droplets will be different.

As discussed above, the Gensler '906 patent fails to anticipate the presently claimed subject matter as recited in amended claim 1, since the Gensler '906 patent does not disclose, teach, or suggest "providing a predetermined amount of a seeding material having uncharged seeding elements of *a predetermined size distribution."* Contrary to the present application, the Gensler '906 patent teaches to use polyelectrolytes of a certain charge polarity (i.e., either cationic polyelectrolyte or anionic polyelectrolyte) (col. 2, lines 32– 44) and a certain molecular weight. Applicants do not agree with the Examiner and submit that molecular weight is not the same characteristic as *size distribution.* It should be understood that polyelectrolyte having macromolecules of a certain molecular weight may be formed in seeding particles having different sizes and size distributions.

Further, the Gensler '906 patent fails to anticipate the presently claimed subject matter as recited in amended claim 1, since the Gensler '906 patent does not disclose, teach, or suggest *"calculating a predetermined polarity and charge magnitude required for electrical charging said uncharged seeding elements by using a collision model."* No suggestion is made by the Gensler '906 patent as to how the *charge magnitude* of the atmospheric droplets and seeding

particles can affect their interaction, and how this interaction can be varied for providing control of the collisions required for droplet precipitation. Therefore, the Gensler '906 patent cannot provide reliable instructions for the error-free control of atmospheric conditions. Although the Gensler '906 patent teaches to use polyelectrolytes of a certain charge polarity, the Gensler '906 patent does not provide any values of charge magnitudes of the atmospheric droplets and seeding particles. No calculations of *polarity and charge magnitude* are carried out by the Gensler '906 patent, *a fortiori*, calculation by using a *collision model* that *"establishes a relationship between the size distribution of the atmospheric water droplets, the size distribution of the seeding elements, and the polarity and charge magnitude of the seeding elements."*

Amended claims 1 and 23 recite a method that includes, *inter alia*, "calculating a predetermined polarity and charge magnitude of seeding elements by using a collision model describing collisions between the charged seeding elements and the microscopic water droplets. Controlling the collisions can be achieved by altering an effective collision rate between the droplets that is proportional, *inter alia*, to a collision efficiency that can be calculated by using computer simulations on the basis of the collision model as described in the application. The calculation of the collision efficiency takes into account, *inter alia*, not only polarity, but also the charge magnitudes and size distribution of the droplets and seeding elements. Examples of the calculation of the collision efficiency as a function of the charges and sizes of the droplets are shown in Fig. 4 for clouds and in Fig. 5 for fog.

In particular, in contrast to the teaching of prior art, the collision efficiency for the smaller droplets/particles for certain charge values can be higher than the collision efficiency for the larger droplets/particles. This unexpected result provides an advantage of the method of the presently claimed subject matter that was unappreciated hitherto. As was mentioned in the Background section of the specification, one of the major requirements of the prior art techniques was the production of large seed particles, since the small particles are not effective for creating large drop-collectors. In particular, the techniques based on seeding combustion products obtained by burning are not sufficiently effective, since the combustion product contains mainly small particles. Thus, the main drawback of the prior art technique that militates against the use of small seed particles is overcome by the presently claimed subject matter, and actually used to

advantage.

Moreover, the method of the presently claimed subject matter allows, *inter alia*, controlling the values of the desired visibility in fog (see, for example, Fig. 7), and the relative rainwater content in clouds (see, for example, Fig. 8A). In particular, according to the presently claimed subject matter, in order to obtain fast increase of visibility in fog, the seeding elements are preferably charged with the opposite polarity charges. In turn, in order to obtain maximum rain enhancement, the seeding elements are preferably charged with the same polarity charges. In all the cases, the charge magnitudes and polarity of the seeding elements should be calculated by using the collision model of the application.

The Gensler '906 patent does not even imply a method for controlling atmospheric conditions in a portion of the atmosphere in which the required polarity and charge magnitudes of the seeding particles could be calculated. Therefore, it is respectfully submitted that there is a substantial advantage in providing a collision model and algorithm with which the man of the art may calculate the magnitudes and polarity of the seeding particles required for desired coalescence and precipitation, without going through a trial and error or hit and miss procedure. None of the prior art documents provides such a model and algorithm, even though the methods for changing atmospheric conditions by producing rainfall or the dispersal of clouds or fog by using charged particles has been known for over seven decades. Thus, in view of these circumstances, it is submitted that the presently claimed subject matter provides a significant inventive step over the prior art.

Moreover, the Gensler '906 patent fails to anticipate the presently claimed subject matter as recited in amended claims 1 and 25, as it does not disclose, teach, or suggest the "*electrical charging* of *the uncharged seeding elements* so as to produce charged seeding elements having a predetermined polarity and charge magnitude."

The Examiner acknowledged on page 6, lines 7-8 of the outstanding Office Action that "Gensler does not teach charging uncharged polyelectrolytes to produce the cationic, anionic or hydrophilic polyelectrolytes" and asserts that the Rembaum et al. '188 patent teaches using insoluble monomer to produce high charge products. Applicants respectfully traverse this proposal and submit that the Rembaum et al. '188 patent does not teach how to achieve charged

products having "predetermined polarity and charge magnitude" with the magnitudes calculated in advance.

Specifically, the Rembaum et al. '188 patent teaches a method of forming polyelectrolytes in aqueous solutions and has no direct relevance to "controlling atmospheric conditions in the atmosphere containing microscopic water droplets to produce their desired coalescence and precipitation".

Applicants respectfully submit that the Rembaum et al. '188 patent fails to cure the deficiencies of the Gensler '906 patent, since the Rembaum et al. '188 patent does not teach, disclose or suggest all of the limitations of independent claims 1 and 23 missing from the Gensler '906 patent discussed above. In other words, the combination of the Gensler '906 patent and the Rembaum et al. '188 patent does not disclose or suggest all of the limitations of independent claims 1 and 23.

Applicants submit that claims 3, 5–7, 9, 10, 14, 15, 21, 23, 25, 27–29, 31, 36, 37, 41 and 45 are allowable not only for their dependence from claim 1 and 23, respectively, but for the presence of additional features not described by either the Rembaum et al. '188 patent or the Gensler '906 patent. For example, neither the Rembaum et al. '188 patent nor the Gensler '906 patent recite, teach or suggest the following features (recited in the dependent claims):

- using electrically charged water droplets (recited in claims 5 and 27);
- using size distribution of the water droplets in said portion of the atmosphere for the calculation of the polarity and charge magnitude of the seeding elements (recited in claims 6 and 28);
- using atmospheric water droplets as seeding material (recited in claim 10);
- using the charged seeding elements with the charge magnitude in the range of about $\pm 10^{-16}$ Coulomb to about $\pm 10^{-12}$ Coulomb (recited in claims 15 and 37);
- controlling of the atmospheric conditions is effected from a ground located source (recited in claims 21 and 45); and
- taking into account an effective collision rate which is proportional at least to a collision efficiency and a concentration of the droplets (recited in claim 41).

As the combination of the Gensler '906 patent and the Rembaum et al. et al. '188 patent fails to disclose, teach or suggest all of the features of independent claims 1 and 23 Applicants submit that the Examiner has failed to make a *prima facie* case of obviousness and claims 1 and 23 are patentably distinct over the cited prior art and request an indication of such.

Further, as claims 3, 5–7, 9, 10, 14, 15, 21, 25, 27–29, 31, 36, 37, 41 and 45 are dependent from previously discussed, patentably distinct and independent claims 1 and 23, Applicants submit that the Examiner has failed to make a *prima facie* case of obviousness and claims 3, 5–7, 9, 10, 14, 15, 21, 25, 27–29, 31, 36, 37, 41 and 45 are patentably distinct over the cited prior art and request an indication of such.

Reconsideration and withdrawal of the rejections under 35 U.S.C. §103(a) are respectfully requested.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance. If the Examiner believes the application is not in condition for allowance, Applicants respectfully request that the Examiner contact the undersigned attorney if it is believed that such contact will expedite the prosecution of the application.

Respectfully submitted,

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